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A recording form for differential diagnosis of arthropathies

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ABSTRACT

The present study is focused on a group of arthropathies that may have very similar bone manifestations (rheumatoid arthritis, ankylosing spondylitis, reactive arthritis, psoriatic arthritis, osteoarthritis and diffuse idiopathic skeletal hyperostosis), which makes it more difficult to diagnose them in human remains from archaeological contexts. A stepwise recording form was designed in order to improve the identification and differential diagnosis of these pathological conditions in bone remains, particularly in joint manifestations of the spine, pelvis, hands, feet and other limb joints. This recording form was applied in the analysis of two medieval individuals from the Basque Country (Spain) who presented very severe arthropathic manifestations. The use of this recording form allowed the researchers the diagnosis of ankylosing spondylitis in one of them and diffuse idiopathic skeletal hyperostosis in the other.

1. Introduction

Arthropathies are the most frequent post-cranial diseases in bone material, in both current and ancient human populations (Rogers and Waldron, 1995). Joint pathologhy can be caused by different factors, with those of inflammatory and degenerative nature being the most common ones. Inflammatory arthropathies are a group of autoimmune diseases triggered by the inability of the immune system to recognize and tolerate one's own antigens. In general, autoimmune diseases do not cause visible lesions in bone tissue, except for a group of arthropathies, among which the following stand out: Rheumatoid Arthritis (RA), Ankylosing Spondylitis (AS), Reactive Arthritis (ReA) and Psoriatic Arthritis (PsA) (Rajic Sikanjic and Vlak, 2010). On the other hand, degenerative arthropathies are illnesses, generally chronic, that worsen in the course of time, with Osteoarthritis (OA) and Diffuse Idiopathic Skeletal Hyperostosis (DISH) being the most common.

For the diagnosis of arthropathies, it is necessary to know which are the most relevant skeletal manifestations to increase the certainty of the diagnosis. In archaeological remains, which present poor preservation, descriptive data of the preserved bone portions are usually taken, without reaching a differential diagnosis in most cases. Therefore, the aim of the present study is to propose a way to record data using a recording form focused on "key" skeletal joints (vertebral, sacroiliac, hands and feet, among others) to establish a diagnosis, and in the case of partial preservation of the skeleton, to reach a presumptive diagnosis. In order to validate the viability and effectiveness of the proposed recording form, it was applied to analyse one individual recovered from the medieval necropolis of San Miguel de Ereñozar (Bizkaia, Basque Country) (13th-15th century) and another one from Cathedral of Santa María de Vitoria-Gasteiz (Álava, Basque Country) (11th-19th), both presenting very severe arthropathic manifestations.

2. Methodology

A literature review of specialized archaeological, anthropological and biomedical journals and textbooks was performed, with the aim of gathering the most important bone manifestations of diseases studied (Rheumatoid Arthritis (RA), Ankylosing Spondylitis (AS), Reactive Arthritis (ReA), Psoriatic Arthritis (PsA), Osteoarthritis (OA) and Diffuse Idiopathic Skeletal Hyperostosis (DISH)).

We describe the diagnostic bone manifestations of the arthropathies included in the recording form.

2.1. Rheumatoid Arthritis (RA)

Rheumatoid Arthritis (RA) characteristically involves the small joints of the hands and feet, especially the metacarpophalangeal joint (MCP), metatarsophalangeal joint (MTP) and proximal interphalangeal joint (PIP), with the distal interphalangeal joint (DIP) being rarely involved (Rogers and Waldron, 1995). It is worth mentioning that diagnosing this disease in archaeological material is impossible if no bone manifestations of the hands and feet can be demonstrated (Rogers et al., 1987). Other joints that become affected in RA are the knee, cervical spine, shoulder, elbow and hip (Resnick, 2002). Erosive lesions are very

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common in RA, as well as osteopaenia (Schett and Gravallese, 2012). The presence of erosive lesions may occur in some Spondyloarthropathies (SpAs); however, unlike in SpAs, the sacroiliac joint is not affected in RA (Rogers et al., 1987).

2.2. Spondyloarthropathies (SpAs): Ankylosing Spondylitis (AS), Reactive Arthritis (ReA) and Psoriatic Arthritis (PsA)

Spondyloarthropathies (SpAs) constitute a group of chronic inflammatory diseases that share a wide spectrum of clinical manifestations, the most important of which are the erosion or fusion of the sacroiliac joint, the involvement of no more than four joints and the formation of new bone tissue around the affected joints (Inoue et al., 1999). Indeed, this group of diseases is characterised by alterations of the fibrocartilaginous entheses, with this being a key feature of SpAs (Ball, 1971; Benjamin and McGonagle, 2001). The most prevalent spondyloarthropathies are the following:

Ankylosing Spondylitis (AS) is a chronic, rheumatic autoimmune disease that affects the spine and sacroiliac joints mostly, although other peripheral joints such as the shoulders, hips and knees may also be affected (Resnick, 2002). The structural changes are caused by inflammatory processes that destroy the bone tissue, which regenerates very quickly, developing over ligaments, tendons and fasciae (Ebringer and Wilson, 2000). The structural changes that identify AS appear in the spine and in the sacroiliac joints. In fact, the inflammation of the sacroiliac joint is the first radiographic manifestation of AS (Raychaudhuri and Deodhar, 2014). Unlike other SpAs, sacroiliitis is symmetrical, affecting both sides of the body equally. However, the changes in the extra-spinal joints are asymmetrical (Rogers et al., 1987).

Ossification begins in the sacroiliac joints and in the lumbar segment of the spine, and from there it moves toward the dorsal and cervical segments (Ebringer and Wilson, 2000) (Fig. 1A). Ossification of the ligaments of the spine joins the intervertebral discs together, resulting in some characteristic bone protuberance in the edges of the vertebral joints known as syndesmophytes. In later stages of the disease, syndesmophytes increase in size, causing the fusion of the vertebrae. In the most severe cases, the spine fuses completely and it acquires the appearance of a bamboo spine (Fig. 1B) (Slaus et al., 2012). It is worth mentioning that, in the case of AS, the growth of new bone tissue affects the entire anterolateral surface of the vertebrae and not only one of the sides, as is the case of DISH (Rogers et al., 1987). Unlike Reactive Arthritis (ReA), in AS the affectation of the vertebrae is continuous and lacks the so-called “skip lesions” (Waldron, 2008).

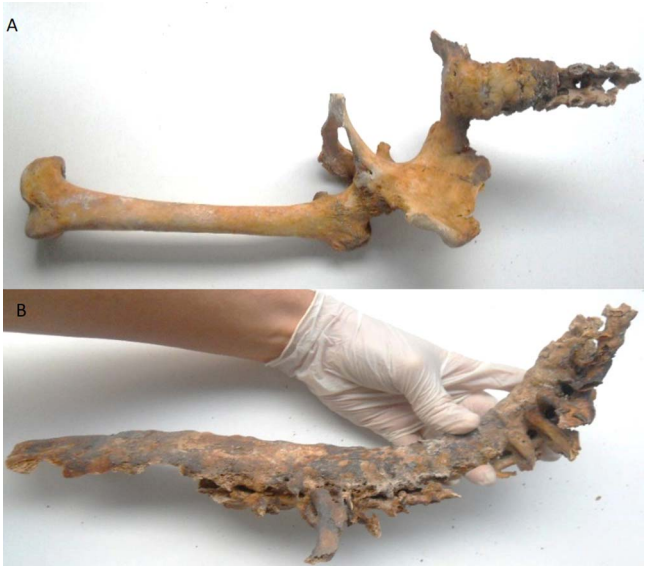

Fig. 1. Characteristic joint manifestations of Ankylosing Spondylitis (AS): A) Fusion of the femur and pelvis, the sacroiliac joint, and the lumbar segment of the spine and B) fusion of the spine with the appearance of a “bamboo spine” (Images courtesy of I.M. Laza).

Reactive Arthritis (ReA) is a disease characterised by peripheral arthritis, enthesopathy and sacroiliitis (Rogers and Waldron, 1995). In ReA sacroiliitis is asymmetrical, in contrast to AS. Moreover, the joints affected are not evenly distributed, thus it is frequent to find normal vertebrae next to fused vertebrae (“skip lesions”). The peripheral joints with more chances of being involved are those of the feet, calcaneus, knees and ankles. These changes are also asymmetrical (Rogers et al., 1987).

In **Psoriatic Arthritis** (PsA) the changes in the sacroiliac joint are usually unilateral or asymmetrical (Rogers and Waldron, 1995). Unlike in ReA, the joints of the hands are affected with the same frequency as those of the feet. The erosive changes are severe and they produce a characteristic appearance of the disease in the phalanges of the hands and feet, known as “pencil-in-cup” (Rogers et al., 1987).

2.3. Osteoarthritis (OA)

Osteoarthritis (OA), widely known as arthrosis, is a chronic, degenerative disease caused by the destruction of joint cartilage. It is the most common of all joint diseases (Ortner, 2003), with age being an important factor (Sowers, 2001). OA is characterised by (1) the formation of marginal osteophytes and/or new bone on the joint surface, (2) the reaction of the subchondral bone, (3) the presence of irregular joint surfaces and, in severe cases, (4) alterations in the contour of the joint. In the absence of (1) and (2), the changes observed in the joint can not be classified as OA. This disease can affect any synovial joint of the body, although in most cases it damages the facet joints of the vertebra, the first metatarsophalangeal joint (MTP), the hip and the knee (Rogers and Waldron, 1995). This arthropathy is characterised by the fact that the osteophytes of the spine develop horizontally from the edge of the joint, in contrast to AS, in which they develop vertically (Rogers et al., 1987). Eburnation is a pathognomonic sign of OA and it occurs when the articular cartilage has completely disappeared (Ortner, 2003).

2.4. Diffuse idiopathic skeletal hyperostosis (DISH)

Diffuse Idiopathic Skeletal Hyperostosis (DISH), also known as Forestief’s disease, is a very common degenerative disorder of unknown aetiology that appears in people of middle and advanced age (Forestier and Rotes-Querol, 1950; Resnick, 1978). The most characteristic trait of DISH is the ossification into the anterior longitudinal ligament. This results in the presence of massive vertical bone formation in the right anterolateral surface of the thoracic vertebrae, generally from T4 to T12 (Rogers and Waldron, 2001). Although this bone outgrowth is more likely to occur on the right side, some changes on the left side can be observed, particularly in the first three thoracic vertebrae and in the lumbar area due to the absence of the descending aorta (Belanger and Rowe, 2001). Its diagnosis requires at least four adjacent thoracic vertebrae to be affected (Mader et al., 2009). This disease is also characterised by the ossification and/or calcification of soft tissue such as tendons, ligaments and other non-skeletal elements (Rogers et al., 1987). In DISH, any entheses may become affected, but the common sites are the triceps insertion in the elbow, the front part of the patella and the insertion of the Achilles tendon into the calcaneus (Rogers and Waldron, 1995; Ortner, 2003). Other distinctive characteristics are the absence of both apophyseal joint degeneration and inflammation of the sacroiliac joints (Verlaan et al., 2007).

DISH is sometimes confused with AS because both have some common manifestations, such as the spinal fusion. However, unlike AS, in DISH there is a preservation of facet joints and disc spaces (Rogers and Waldron, 1995). On the other hand, in DISH the development of